Simultaneous Real Time Micro-Bathymetric Data From a Laser Line Scanning System and Acoustic Backscatter

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LONG-TERM GOAL

Since this proposal is meant to be integrated with the high frequency acoustics DRI, the goals of that program are essentially the goals of the research proposed here. That is, the program seeks to gain a fundamental understanding of the processes that are taking place in the high frequency scatter of sound from the sea bottom. This includes the physics, geology and biology of the interaction of sound with the sea floor.

OBJECTIVES

The immediate objective of this program is to create and test a sensor which can measure high resolution bottom bathymetry in-situ. Here, our goal is two fold: (1) To measure a two dimensional detailed map of the bottom to a resolution of mms (isotropically). (2) To measure a time sequence of such bottom bathymetry so that we will be able to look at bottom change, be it induced by currents or animals.

APPROACH

Under separate funding from the environmental optics program we have recently finished the development of a laser bathymetry system prototype: L-Bath. The system has been tested in both artificial and natural settings and we have found that the system broadly satisfies its engineering specifications. This proposal funded the adoption of this system to allow it to make repetitive scans of a bottom area. Our approach consists of fabricating an aluminum apparatus which is a frame upon which the system is mounted. The frame contains a device for translating the system which permits the one dimensional laser line scan to survey a two dimensional area. Dimensions of the area are 3 m x 1 m.

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WORK COMPLETED

During this year of the project we have completed our initial development of the device for translating the underwater bathymetry system and we have tested it in an area adjacent to the SIO Pier as well as a field trip in the Bahamas. Based on the field exercise, the system was modified to have less hydrodynamic signature and greater range. Tests of the newer system were completed prior to deployment in the SAX99 field program and the device was found to work well.

RESULTS

Figure 1 shows the device situated on the SIO Marine Facility Pier in Pt. Loma. Shown is the aluminum frame and the motor and wire apparatus for translating the device.

Figure 1: The underwater translation device above a Manta Mine.

The device was deployed in the spring of '99 in the COBOP field program in the Bahamas at Lee Stocking Island. As part of the characterization of the device, repetitive scans were made of the same line by holding the device fixed. From this data, a standard deviation of the estimated depth of the set of 500 scans was computed. This number was close to 3 mm for most of the estimated positions, except when fish were found to interfere with the measurement. On the basis of these preliminary tests, the frame was slightly redesigned to insure more stability and to also raise the device higher off the bottom. In addition, a set of sea "screws" were added to the legs so that the device could be secured in a better way to the bottom. Results of the modifications were tested from the SIO Pier in the fall of 1999 and found to be suitable. Initial results from the SAX99 field program indicate that the device is performing as designed.

IMPACT/APPLICATIONS

We anticipate that the system will have a major impact on the interpretation of the acoustical data for the SAX99 experiments. Measurement of bottom bathymetry to this resolution over short time scales should provide a unique source of information about the sea floor for interpretation of the acoustic results.

TRANSITIONS

This project, itself, represents a transition from the environmental ocean optics program to the acoustics and biology program. Additional uses of the system for measuring this kind of microbathymetry will now be possible.

RELATED PROJECTS

This program would not be possible without the large contribution to the development of the L-Bath program by the Environmental Ocean Optics program, operated by Drs. Steve Ackleson and Joan Cleveland. Over the last several years, that office has funded the development of this system and its transition to a true sea going system. In addition, the COBOP program provided an excellent site for the field deployment of the underwater translation device and its characterization.

Other programs related to this one consist of many of the acoustics experiments that are being performed by the SAX99 team. As an example, the BAMS towers operated by APL-UW are collecting high frequency backscatter information and measuring temporal decorrelation of the acoustical signals. Since the acoustic backscatter is a function of surface scattering the temporal changes that we measure should be relatable to the acoustic changes.